Software Specification

GSE Gateway Services CSCI Atlas DP2

Checkout and Launch Control System (CLCS)

84K00720-001

Approval:

Kirk Lougheed Chief, SE&I	Date		Date
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	Date		Date

NOTE: See "**Supporting Document Note**" on following page

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Supporting Document Note: Acronyms and definitions of many common CLCS terms may be found in the following documents: CLCS Acronyms 84K00240 and CLCS Project Glossary 84K00250.

REVISION HISTORY

REV	DESCRIPTION	DATE

LIST OF EFFECTIVE PAGES				
Dates of issue of change pages are:				
Page No.	**A or D***	**Issue or Change No.**	**CR No.**	**Effective Date****

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SOFTWARE SPECIFICATION

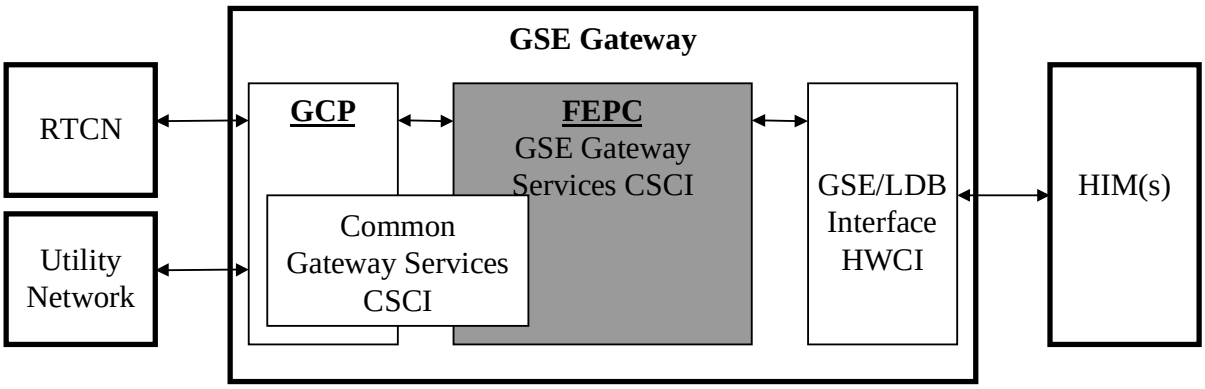
GSE GATEWAY SERVICES CSCI ATLAS DP2

CHECKOUT AND LAUNCH CONTROL SYSTEM (CLCS)

1. INTRODUCTION

1.1 GSE GATEWAY SERVICES OVERVIEW

The GSE Gateway Services CSCI provides the functionality required for interfacing the CLCS system with a HIM Ground Data Bus (GDB). This functionality includes the ability to issue commands to and poll measurement information from GSE HIM's. Measurement Polling and data conversion are controlled using tables supplied by the Test Build & Control CSCI. The GSE Gateway Services CSCI resides on the Front End Control Processor (FEPC) within the GSE gateway. The CSCI interfaces to the HIM GDB through the GSE/LDB HWCI and to the CLCS system through the Common Gateway Services CSCI.



1.2 GSE GATEWAY SERVICES CSCI GROUNDRULES

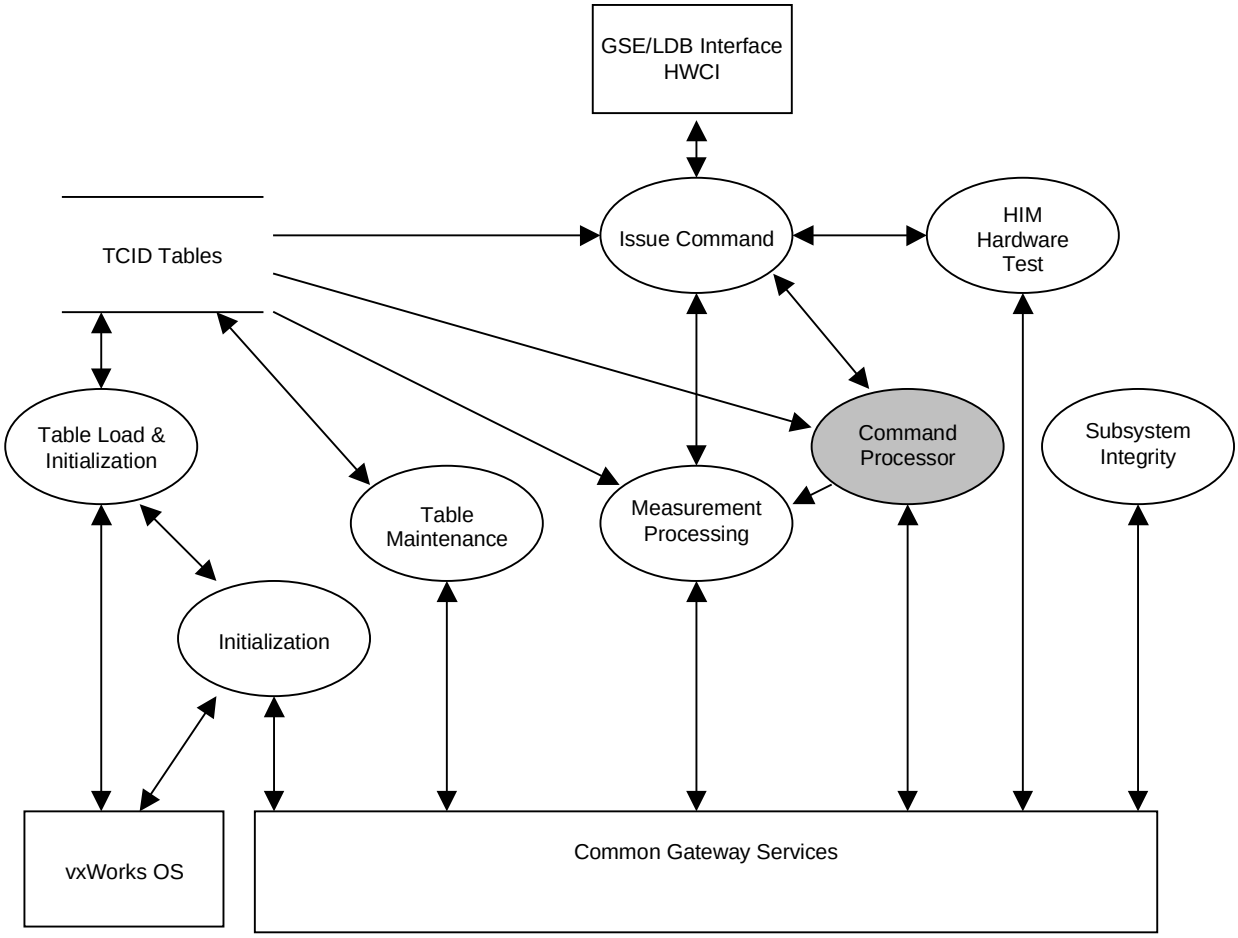
1. HIM Type II functionality will not be provided in the Atlas delivery.
2. CITE fuel cell simulation is no longer a requirement for CLCS.
3. GSE Gateway Services CSCI will be modified to make use of the production LDB/GSE HWCI.
4. The standby gateway will monitor the active gateway's uplink and downlink busses. This capability will provide a significant head start towards the anticipated final functionality of the standby GSE gateway. No switch scan is required when a switchover occurs since the current value table is always up to date. In addition, GDB commands will be queued and issued by the standby after a switchover if they were never issued by the former active gateway. No command response will be sent if the command is issued by the former standby gateway.

2. GSE COMMAND PROCESSOR CSC

2.1 GSE COMMAND PROCESSOR CSC INTRODUCTION

2.1.1 GSE Command Processor CSC Overview

The GSE Command Processor CSC is responsible for interpreting, verifying and executing all HIM GDB commands received from the CLCS system. Command responses are returned to the issuer of the command.



2.1.2 GSE Command Processor CSC Operational Description

The GSE Command Processor CSC registers all HIM GDB commands via the Common Gateway Services CSCI. Commands are decoded and error checked prior to issuance to the HIM.

In case of a command response error, the command is retried a maximum of two additional times before a failure is returned to the issuer of the command.

The HIM response is converted to CLCS format and returned to the issuer of the command. The command response data is also routed through measurement processing and becomes part of the change data stream.

Only the active gateway will issue the command on the GDB. *The standby gateway will monitor the active gateway's uplink and downlink busses to verify the command was successfully issued. If a switchover is commanded before this verification is performed, the standby will issue the command on the GDB when the switchover completes.*

2.2 GSE COMMAND PROCESSOR CSC SPECIFICATIONS

2.2.1 GSE Command Processor CSC Groundrules

- None

2.2.2 GSE Command Processor CSC Functional Requirements

1. The interface to the CLCS system will be implemented using the Common Gateway Services CSCI.

2. The GSE Command Processor CSC will communicate all commands and responses to the CLCS system using the Common Gateway Services CSCI.

3. The GSE Command Processor CSC will support the following operational commands:
   - 3.1. Set (discrete FD's)
   - 3.2. Apply (analog FD's)
   - 3.3. Issue (digital pattern FD's)
   - 3.4. Read discrete
   - 3.5. Read analog
   - 3.6. Read digital pattern

4. The GSE Command Processor CSC in the active gateway will respond to the Set and Apply commands with the following data:
   - 4.1. IEE 754 previous value (analog only)
   - 4.2. IEEE 754 requested value (analog only)
   - 4.3. IEEE 754 actual value (analog only)
   - 4.4. Previous output
   - 4.5. Requested output
   - 4.6. Actual output
   - 4.7. Completion Code

5. The completion code for the set ,apply, issue, and read command responses will contain one of the following:
   - 5.1. Successful
   - 5.2. Invalid gateway mode
   - 5.3. Invalid FDID
   - 5.4. Data type error
   - 5.5. Command disabled
   - 5.6. HIM GDB error
   - 5.7. HIM Time-out
   - 5.8. Invalid FDID Type

6. When an error is detected during command processing, the GSE Command Processor CSC in the active gateway will retry the command a maximum of two additional times.

7. Upon completion of a command retry, the GSE Command Processor CSC in the active gateway will issue a

system message indicating success or failure, number of retries and description of the error.

8. The GSE Command Processor CSC in the active gateway will complete the current command, including any retries required, before proceeding to the next command.

9. The GSE Command Processor CSC in the active gateway will verify the new commanded state contained in the HIM response data.

10. The GSE Command Processor CSC in the active gateway will verify the state of the discretes within the discrete group that should be unaffected by a discrete command request and issue a system message if any discrete fails the verification.

11. The GSE Command Processor CSC in the active gateway will output the current commanded state of all discretes within the discrete group that changed via the change data interface of the Common Gateway Services CSCI.

12. The GSE Command Processor CSC will be capable of generating system messages through the Common Gateway Services CSCI.

13. The GSE Command Processor CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port

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14. The GSE Command Processor CSC in the standby gateway will place all GDB commands received from the RTCN on an internal holding queue.

15. The GSE Command Processor CSC in the standby gateway will remove a command from the holding queue when:
    15.1. The active gateway sends the command and receives a successful response
    15.2. The active sends the command three times with no successful response.

16. The GSE Command Processor CSC in the standby gateway will output any commands that remain in the holding queue after a switchover occurs.

17. The GSE Command Processor CSC in the standby gateway will not generate a command response for commands sent from the holding queue.

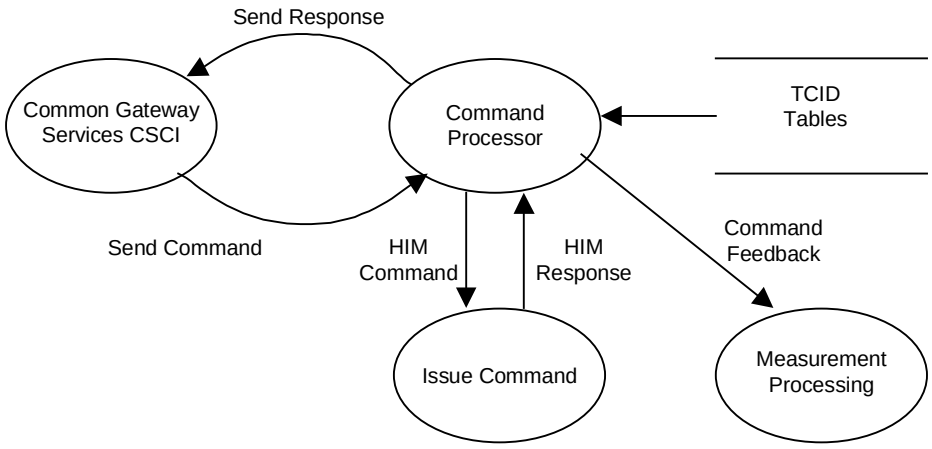
18. The GSE Command Processor CSC in the standby gateway will output a system message for each command sent from the holding queue.

2.2.3 GSE Command Processor CSC Performance Requirements

1. GSE Gateway Services will be capable of processing 500 uplink commands per second

2.2.4 GSE Command Processor CSC Data Flow Diagram

External Data Flow Diagram



The GSE Command Processor CSC is responsible for carrying out all GDB commands received from the RTCN. The Command Processor CSC registers all GDB commands via the Common Gateway Services CSCI. The following checks are made prior to forwarding the command to the Issue Command CSC:

- Data acquisition is active
- The gateway is in active mode
- The FDID is valid
- The data type is correct
- Global command issuance is enabled
- FD command issuance is enabled

The GSE Command Processor CSC in the active gateway forwards the command to the Issue Command CSC for output on the GDB. The HIM response is converted to RTCN format and returned to the command issuer via the Common Gateway Services CSCI. Command errors and retries are handled by this CSC.

The standby gateway will monitor the active gateway's uplink and downlink busses to verify the command was successfully issued. If a switchover is commanded before this verification is performed, the standby will issue the command on the GDB when the switchover completes.

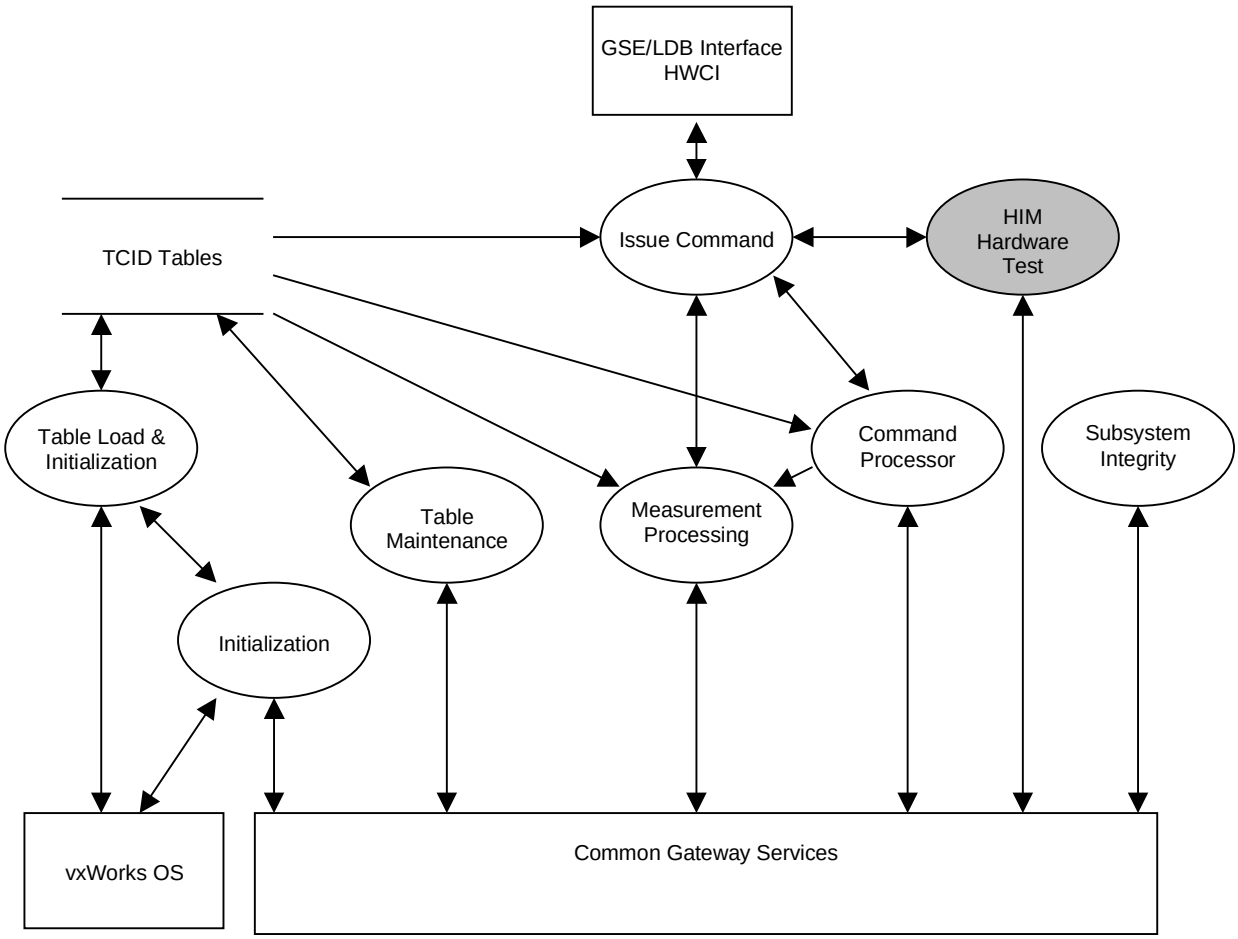
Commands responses in the active gateway are sent to Measurement Processing for output to the change data stream.

3. GSE HIM HARDWARE TEST CSC

3.1 GSE HIM HARDWARE TEST CSC INTRODUCTION

3.1.1 GSE HIM Hardware Test CSC Overview

The GSE HIM Hardware Test CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for performing cyclic tests on each HIM being polled and on each I/O card within the HIM. System messages are generated when errors are detected.



3.1.2 GSE HIM Hardware Test CSC Operational Description

The GSE Gateway HIM Hardware Test CSC accepts commands from the RTCN via the Common Gateway Services CSCI. These commands provide the ability to start and stop HIM test and also to inhibit and activate testing on a particular HIM or FD. The HIM Hardware Test CSC sends approximately four commands per second to the HIMs. Two of the commands are HIM wrap test and HIM bus test. The commands are cycled through all connected HIM's. The other two commands are I/O card tests. These are defined as all one's and all zero's tests for discrete and digital pattern

measurement cards or 20% and 80% calibration tests for analog measurement cards. The HIM Hardware Test CSC will also perform the HIM switch scan function where HIM command card outputs are read and compared to their expected states.

3.2 GSE HIM HARDWARE TEST CSC SPECIFICATIONS

3.2.1 GSE HIM Hardware Test CSC Groundrules

1. The GSE HIM Hardware Test CSC will incorporate the CCMS HIM switch-scan functionality.

3.2.2 GSE HIM Hardware Test CSC Functional Requirements

1. The GSE HIM Hardware Test CSC will process requests to activate/inhibit global HIM hardware testing.

2. The GSE HIM Hardware Test CSC will process requests to activate/inhibit global switch scan testing.

3. The GSE HIM Hardware Test CSC will process requests to activate/inhibit HIM hardware testing and/or switch scan on a HIM.

4. The GSE HIM Hardware Test CSC will process requests to activate/inhibit HIM hardware testing and/or switch scan on an FDID

5. Activate or inhibit HIM hardware test or switch scan on a discrete FD will activate or inhibit the entire channel.

6. The GSE HIM Hardware Test CSC will issue a HIM test command only when:
   - 6.1. Global command issuance is enabled
   - 6.2. Global HIM testing is enabled
   - 6.3. Data acquisition is enabled
   - 6.4. The HIM under test is active
   - 6.5. The HIM under test has HIM test active
   - 6.6. The measurement under test has HIM test active.
   - 6.7. The GSE gateway mode is active **(new for Atlas)**

7. The GSE HIM Hardware Test CSC will be activated as a result of the activate-data-acquisition command provided HIM test has not been inhibited by a previous inhibit global HIM hardware testing command.

8. The GSE HIM Hardware Test CSC will maintain the following information and make it available to subsystem integrity and to the gateway maintenance interface:
   - 8.1. HIM test active / inhibited
   - 8.2. Low calibration test count
   - 8.3. Low calibration fail count
   - 8.4. High calibration test count
   - 8.5. High calibration fail count
   - 8.6. All zeros test count
   - 8.7. All zeros fail count
   - 8.8. All ones test count
   - 8.9. All ones fail count
   - 8.10. Wrap test count
   - 8.11. Wrap fail count
   - 8.12. Bus test count
   - 8.13. Bus test fail count

9. The GSE HIM Hardware Test CSC will maintain a list of the last 50 errors that have occurred.

10. The GSE HIM Hardware Test CSC will maintain the following information for each hardware test error:
    10.1. Error type
    10.2. HIM address
    10.3. HIM card/function code
    10.4. Data word sent
    10.5. Data word received
    10.6. SR I value
    10.7. SR II value

11. The last fifty HIM hardware test errors will be made available to the RTCN by command.

12. The GSE HIM Hardware Test CSC will consider an analog low calibration test successful only if the HIM response is between plus or minus 1 bit of the 20% full scale value (0x33).

13. The GSE HIM Hardware Test CSC will consider an analog high calibration test successful only if the HIM response is between plus or minus 1 bit of the 80% full scale value (0xCC).

14. The GSE HIM Hardware Test CSC will consider a HIM discrete all ones test successful only if the HIM returns all logic ones in its response.

15. The GSE HIM Hardware Test CSC will consider a HIM discrete all zeroes test successful only if the HIM returns all logic zeroes in its response.

16. The GSE HIM Hardware Test CSC will consider a HIM wrap test successful only if the exact bit pattern issued is returned by the HIM.

17. The GSE HIM Hardware Test CSC will perform the HIM switch scan function unless disabled by command.

18. The GSE HIM Hardware Test CSC switch scan function will read HIM output status, compare the current state of each output with the current value in the CMDT and report miscompares when they occur.

19. The GSE HIM Hardware Test CSC will be capable of issuing a minimum of four HIM hardware tests per second when HIM hardware testing is active.

20. The GSE HIM Hardware Test CSC will issue a minimum of two HIM card tests per second when HIM hardware testing is active.

21. The GSE HIM Hardware Test CSC will issue a minimum of two HIM wrap or bus test commands per second when HIM hardware testing is active.

22. The GSE HIM Hardware Test CSC will be capable of generating system messages through the Common Gateway Services CSCI.

23. The GSE HIM Hardware Test CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port.

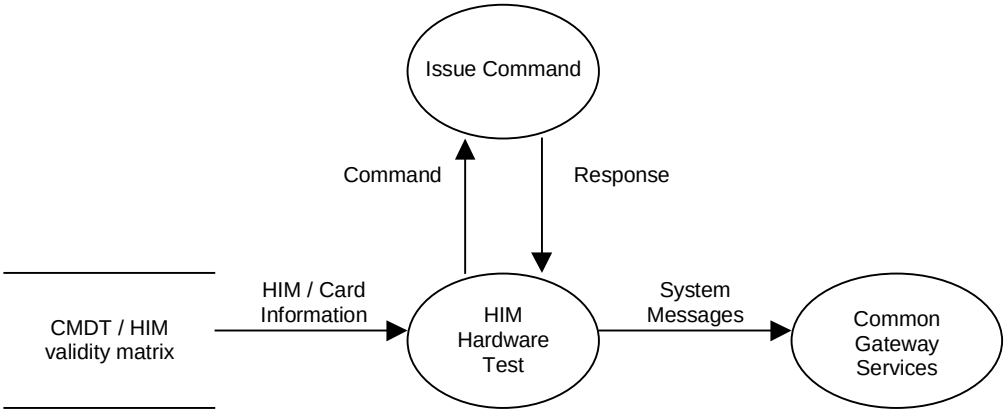
NO NEW REQUIREMENTS FOR ATLAS

3.2.3 GSE HIM Hardware Test CSC Performance Requirements

None

3.2.4 GSE HIM Hardware Test CSC Data Flow Diagram

External Data Flow Diagram



The HIM Hardware Test CSC interfaces to the GSE Issue Command CSC and to the local CMDT and HIM status tables.

The HIM command to be output is determined by examining the HIM status matrix and the CMDT.

The HIM test command is sent to the GSE Issue Command CSC for output on the GDB. HIM responses are returned in a response queue created as part of the HIM Hardware Test CSC.

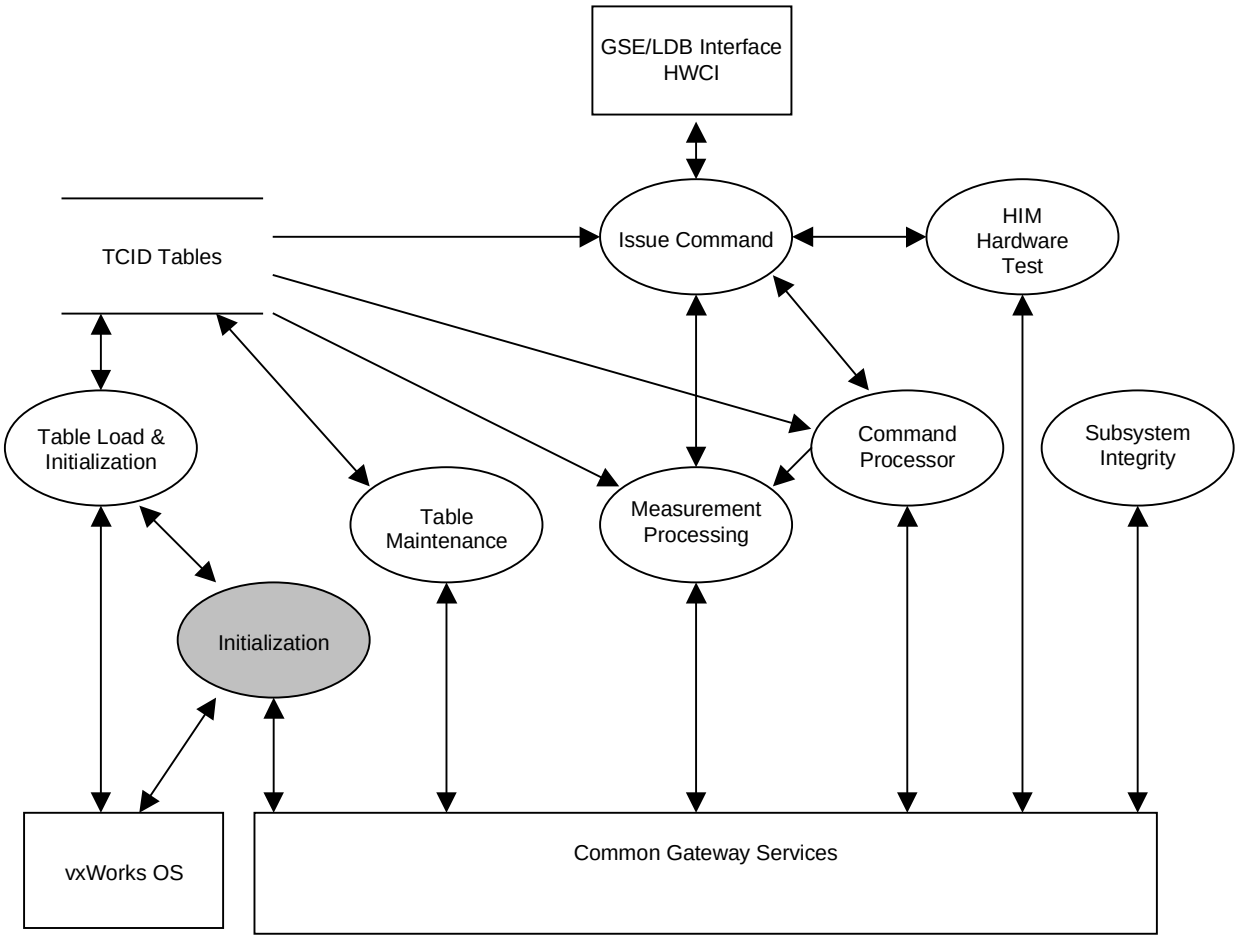
A log of the last fifty errors is maintained.

4. GSE INITIALIZATION CSC

4.1 GSE INITIALIZATION CSC INTRODUCTION

4.1.1 GSE Initialization CSC Overview

The GSE Initialization CSC is responsible for performing all initialization that is unique to the GSE Front End Control Processor. The GSE Initialization CSC provides the table load and activation functions required by the Common Gateway Services CSCI. The GSE Initialization CSC also processes all initialization commands that are GSE specific.



4.1.2 GSE Initialization CSC Description

The GSE Initialization CSC provides the activation, shut down, and termination functions that are defined by the Common Gateway Services CSCI. These functions are called during processing of commands issued by OPS/CM. The activation function performs all GSE specific activation, which includes initialization of the front-end hardware as well as all GSE Gateway Services CSC's. The shut down function terminates the interface to the LDB/GDB HWCI. The termination function terminates all GSE Gateway Services CSC's except the GSE Initialization CSC. The GSE Initialization CSC is also responsible for executing the Activate/Inhibit Data Acquisition, Activate/Inhibit Data Processing, Activate/Inhibit Global Commands, and determine HIM presence commands.

4.2 GSE INITIALIZATION CSC SPECIFICATIONS

4.2.1 GSE Initialization CSC Groundrules

None

4.2.2 GSE Initialization CSC Functional Requirements

1. The GSE Initialization CSC will support the following initialization commands:
   - 1.1. Activate/Inhibit Data Acquisition
   - 1.2. Activate/Inhibit Data Processing
   - 1.3. Activate/Inhibit Command Issuance Globally
   - 1.4. Determine HIM Presence
   - 1.5. Terminate

2. The GSE Initialization CSC will record initialization messages on local storage media.

3. The GSE Initialization CSC will generate a system message prior to termination, whether due to an error or by command.

4. The GSE Initialization CSC will record all termination messages on local storage media.

5. The GSE Initialization CSC will be capable of generating system messages through the Common Gateway Services CSCI.

6. The GSE Initialization CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port.

7. The GSE Initialization CSC will process requests to activate/inhibit data acquisition.

8. The GSE Initialization CSC will process requests to activate/inhibit data processing.

9. The GSE Initialization CSC will process requests to activate/inhibit command issuance globally.

10. The GSE Initialization CSC will not activate an individually inhibited FD command when processing the global command issuance command.

11. The GSE Initialization CSC in the active gateway will issue a FAIL RESET, LOCKOUT RESET, SR RESET and SR I READ (HIM wake-up sequence) to all 256 possible HIMs during processing of the following commands:
    - 11.1. Activate gateway
    - 11.2. Activate data acquisition
    - 11.3. Determine HIM presence

12. The GSE Initialization CSC in the active gateway will issue a HIM Lockout command to those HIMs that did not respond to the HIM wake-up sequence.

13. The GSE Initialization CSC in the active gateway will maintain status indicating which HIMs are present based on the result of the HIM wake-up sequence.

14. The GSE Initialization CSC in the active gateway will issue a system message if any HIMs defined in the

CMDT are not present.

15. The GSE Initialization CSC in the active gateway will issue a system message if any HIMs are present which are not in the CMDT.

16. The GSE Initialization CSC in the active gateway will process command requests to determine HIM presence.

17. The GSE Initialization CSC in the active gateway will repeat the HIM wake-up sequence if a determine-HIM-presence command is received while data acquisition is inhibited.

18. The GSE Initialization CSC in the active gateway will return the result of the last HIM wake-up sequence if a determine-HIM-presence command is received while data acquisition is enabled.

19. The GSE Initialization CSC in the active gateway will validate the GSE facility configuration as part of the following commands:
    19.1. Activate gateway
    19.2. Activate data acquisition
    19.3. Determine HIM presence

20. The GSE Initialization CSC in the active gateway will issue a system message indicating success or failure of facility verification.

21. The GSE Initialization CSC in the active gateway will terminate the activate-data-acquisition command and generate a fail response if facility verification fails and facility verification override has not been specified.

22. The GSE Initialization CSC in the active gateway will bypass facility verification if facility verification override is specified in the activate-data-acquisition command.

23. The GSE Initialization CSC in the active gateway will output a system message indicating facility verification was not performed if facility verification override is specified in the activate-data-acquisition command.

24. The GSE Initialization CSC in the active gateway will make the result of the facility verification available for health / status output and display.

25. The GSE Initialization CSC in the active gateway will read the HIM output status prior to the start of data acquisition and update status in the CMDT.

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26. The GSE Initialization CSC in the active gateway will read all measurements in the CMDT prior to the start of data acquisition and bypass all measurements that return an error response.

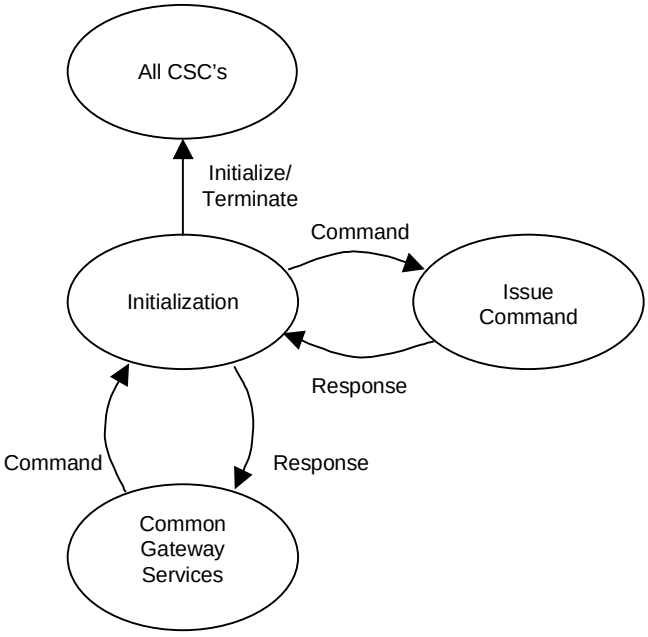
27. The GSE Initialization CSC will not perform facility verification during an activate-data-acquisition sequence that is the result of a switchover request.

4.2.3 GSE Initialization CSC Performance Requirements

No performance requirements have been identified for this CSC.

4.2.4 GSE Initialization CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



The GSE Initialization CSC provides functions that are called as part of initialization command processing by the Common Gateway Services CSCI.

The GSE Initialization CSC controls the initialization and termination of all other GSE unique CSC's on the GSE Front End Process Controller (FEPC). CSC initialization is performed by calling an initialization function provided by each CSC. All CSC's also provide a termination function that is called when a Terminate command is received.

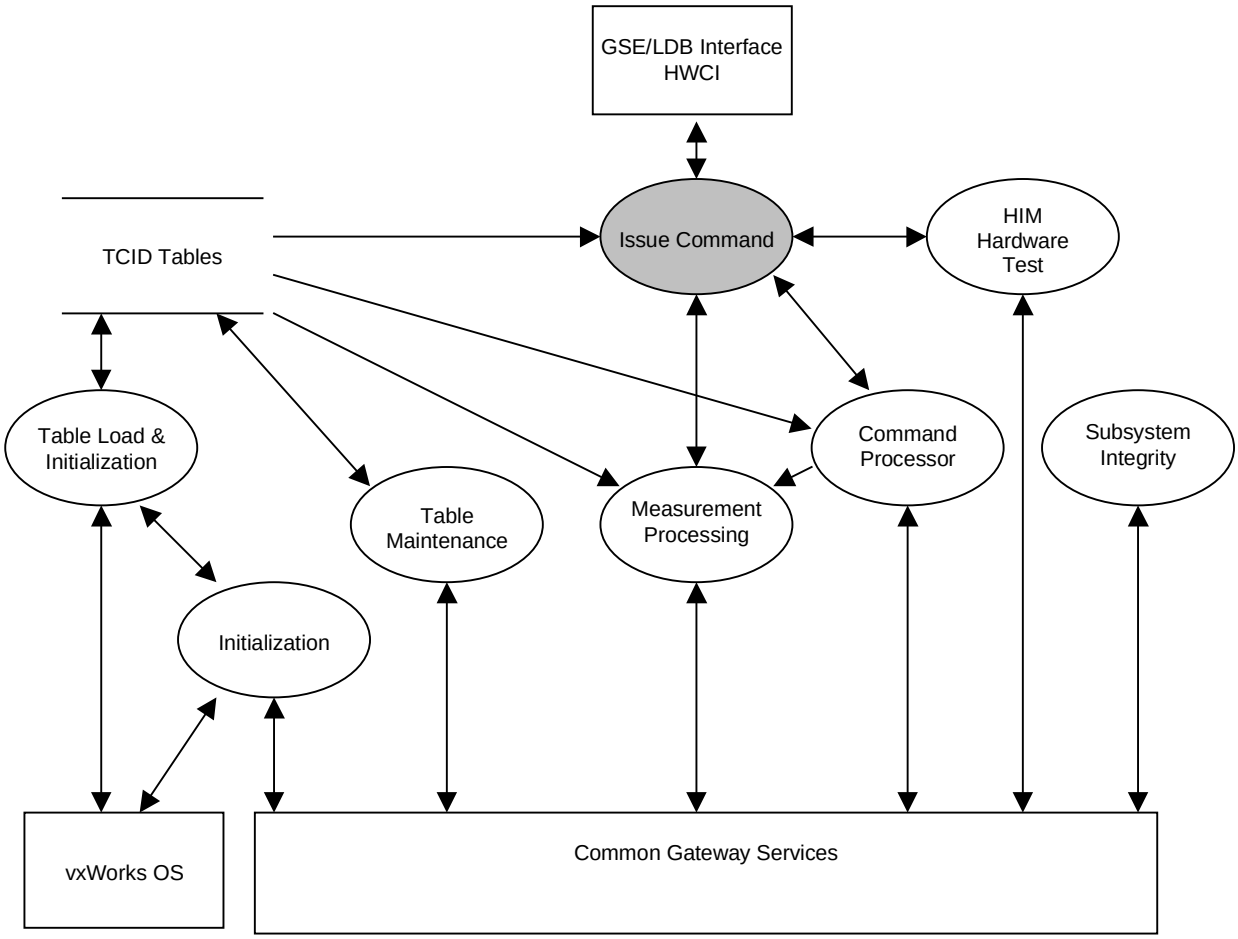
The GSE Initialization CSC interfaces to the GSE Issue Command CSC in order to perform the HIM roll call and switch-scan functions.

5. GSE ISSUE COMMAND CSC

5.1 GSE ISSUE COMMAND CSC INTRODUCTION

5.1.1 GSE Issue Command CSC Overview

The GSE Issue Command CSC is responsible for all communications with the GSE/LDB Interface HWCI and thus with the HIM Ground Data Bus (GDB). This CSC accepts requests for command and measurement polls from other CSC's. These requests are translated into the format required by the GFSE/LDB HWCI and transmitted on the GDB. The response is returned to a queue that is specified as part of the poll request. This CSC is responsible for detecting and reporting any errors that occur on the GDB.



5.1.2 GSE Issue Command CSC Operational Description

The GSE Issue Command CSC provides several functions for use by other CSC's. The parameters to these functions define all information required to format a request for the HIM GDB. The parameters also include a message queue id. The message queue is the destination for the HIM response data and status.

The GSE Issue Command CSC in the active gateway will format the request for output on the GDB and will store

information about the GDB transaction and its final destination on an expected response queue. The GSE Issue Command CSC will receive the response from the GDB, check it for errors, and place the response data and status on the specified queue.

The GSE Issue Command CSC in the standby gateway will monitor the uplink and downlink data busses. Downlink data will be correlated with uplink data and the correlated data will be forwarded to the Measurement Processing CSC and the Command Processing CSC.

When GDB errors are detected, the GSE Issue Command CSC in the active gateway will output a system message containing the reason for the error. The HIM status register will be read and reset for those errors which require the status register to be cleared.

5.2 GSE ISSUE COMMAND CSC SPECIFICATIONS

5.2.1 GSE Issue Command CSC Groundrules

- The GSE Issue Command CSC will support the following data types only:
  - Discrete Stimulus (DS)
  - Discrete Measurement (DM)
  - Analog Stimulus (AS)
  - Analog Measurement (AM)
  - Digital Pattern Stimulus (DPS)
  - Digital Pattern Measurement (DPM)

5.2.2 GSE Issue Command CSC Functional Requirements

1. The GSE Issue Command CSC will be capable of supporting at least 16 HIM's on the GSE data bus.

2. The GSE Issue Command CSC in the active gateway will send a system message when any GSE data bus or HIM errors are detected.

3. The GSE Issue Command CSC will inhibit the polling of a HIM upon detection of a terminal error defined as a HIM Bus Test Error, a HIM Power Failure, or a HIM Failure Signal.

4. When a HIM is inhibited due to an error, the GSE Issue Command CSC will inhibit HIM polling on all entries in the CMDT that relate to the inhibited HIM.

5. When a HIM is inhibited by command, the GSE Issue Command CSC will set a global flag for the HIM to prevent polls from occurring.

6. After a HIM is inhibited by an error, activation of HIM polling on an FD in the inhibited HIM will cause that FD to be polled, even though the HIM remains inhibited.

7. When a HIM is inhibited due to error or by manual command, the GSE Issue Command CSC will update measurement and command status for all FDID's associated with the HIM.

8. When a HIM is inhibited due to error or by manual command, The GSE Issue Command CSC in the active gateway will output a system message.

9. The GSE Issue Command CSC will provide the capability to detect and report non-terminal HIM hardware failures (Over Temperature Warning, Logic Error, Ready Time-out, Multiple Acknowledge, and Acknowledge Time-out).

10. The GSE Issue Command CSC will inhibit polling on a HIM channel upon detection of a non-terminal error response from that channel.

11. When a measurement is inhibited due to error, The GSE Issue Command CSC in the active gateway will output a system message.

12. The GSE Issue Command CSC will continue polling the HIM when a non-terminal error is detected.

13. The GSE Issue Command CSC will detect error conditions on the GSE data bus.

14. The GSE Issue Command CSC in the active gateway will issue a bus request to read the HIM Status Register II prior to issuing a status register reset command to a HIM during error processing.

15. The GSE Issue Command CSC in the active gateway will include the HIM Status Register II contents in the system message that reports the error condition.

16. The GSE Issue Command CSC in the active gateway will issue a HIM status register reset for all non-terminal HIM errors except successive over-temperature warning from a HIM.

17. The GSE Issue Command CSC will not perform a status register read or reset due to a status register read or reset error.

18. The GSE Issue Command CSC in the active gateway will perform hardware address verification to the card address level for all responses from HIM's.

19. The GSE Issue Command CSC in the active gateway will provide the capability to detect HIM hardware address miscompare (timeout or unsolicited response) error conditions.

20. The GSE Issue Command CSC will continue HIM polling when hardware address miscompare errors occur.

21. The GSE Issue Command CSC in the active gateway will send a system message to report a HIM hardware address miscompare (timeout).

22. The GSE Issue Command CSC will be capable of generating system messages through the Common Gateway Services CSCI.

23. The GSE Issue Command CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port.

24. The GSE Issue Command CSC will maintain HIM status.

25. The GSE Issue Command CSC will maintain hardware error counters.

26. The GSE Issue Command CSC in the active gateway will issue HIM status register reset commands without regard to whether global command issuance has been inhibited.

27. The GSE Issue Command CSC in the active gateway will not issue status register reset commands to a HIM which has been inhibited during HIM error processing.

28. The GSE Issue Command CSC in the active gateway will report over-temperature warnings only if the previous status register read did not contain an over-temperature warning (consecutive over-temperature warnings will

not be reported).

29. The GSE Issue Command CSC in the active gateway will not perform a status register reset if the over-temperature warning is the only error reported in the status register.

30. The GSE Issue Command CSC will maintain the following information and make it available to subsystem integrity and to the gateway maintenance interface:
    30.1. Fail signal count
    30.2. Power supply fail count
    30.3. Acknowledge time-out count
    30.4. Multi-ack error count
    30.5. Ready time-out count
    30.6. Bus test error count
    30.7. Logic error count
    30.8. Over-temperature warning count
    30.9. Status register resets issued count
    30.10. GDB length error count
    30.11. GDB parity error count
    30.12. GDB manchester error count
    30.13. GDB timeout error count
    30.14. GDB SR error count
    30.15. GDB unsolicited response error count
    30.16. Measurement poll count
    30.17. Command count

31. The GSE Issue Command CSC in the active gateway will validate both global and individual command inhibit status before issuing a TEI command.

32. The GSE Issue Command CSC will initialize the front-end interface hardware upon receipt of an activate command.

33. Upon receiving three consecutive errors on the same HIM channel, the GSE Issue Command CSC will inhibit output of system messages for that channel.

34. The GSE Issue Command CSC will, upon receiving a successful poll for a channel with system messages inhibited, reset the channel error counter and output a system message indicating that system messages have been restored for the channel.

35. The GSE Issue Command CSC will maintain the following information for each HIM (HIM status table):
    35.1. HIM polling active
    35.2. HIM inhibited by command
    35.3. HIM inhibited by terminal error
    35.4. HIM hardware testing active
    35.5. HIM status register I last value
    35.6. HIM status register II last value

36. The GSE Issue Command CSC will make the HIM status table available to Subsystem Integrity.

NEW REQUIREMENTS FOR ATLAS

37. The GSE Issue Command CSC in the standby gateway will monitor the uplink and downlink busses and will correlate the downlink data with the uplink.

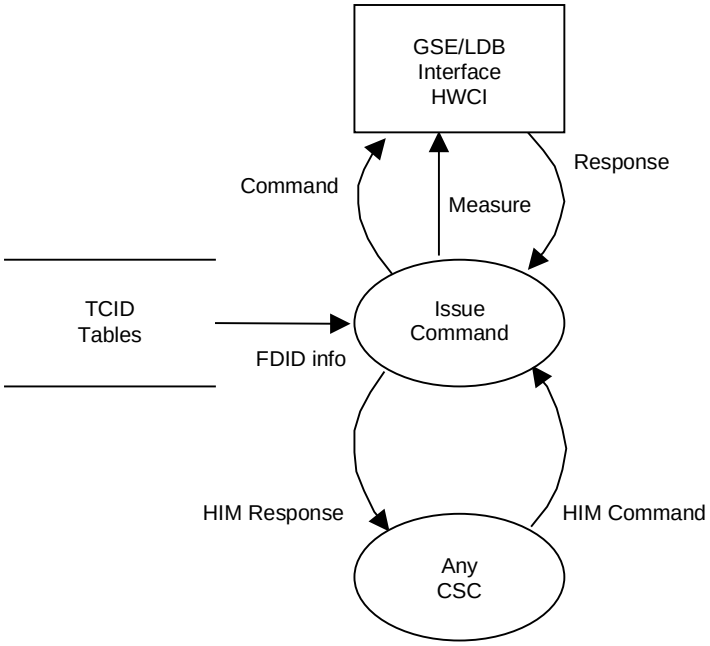
38. The GSE Issue Command CSC in the standby gateway will forward the correlated data to the Command Processor CSC and the Measurement Processing CSC.

5.2.3 GSE Issue Command CSC Performance Requirements

1. GSE Issue Command CSC will be capable of processing 10,000 HIM polls per second.
2. GSE Issue Command CSC will be capable of processing 500 uplink commands per second

5.2.4 GSE Issue Command CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



The GSE Issue Command CSC is responsible for all communications over the HIM Ground Data Bus (GDB). The CSC accepts HIM requests from any GSE Gateway Services CSC. These commands are converted to GDB format using information from the TCID tables and sent to the GSE/LDB HWCI for output to the HIM. The response from the HIM is routed from the HWCI back to the appropriate CSC. The GSE Issue Command CSC is also responsible for initializing the GSE/LDB Interface HWCI and for detecting and reporting all GDB errors.

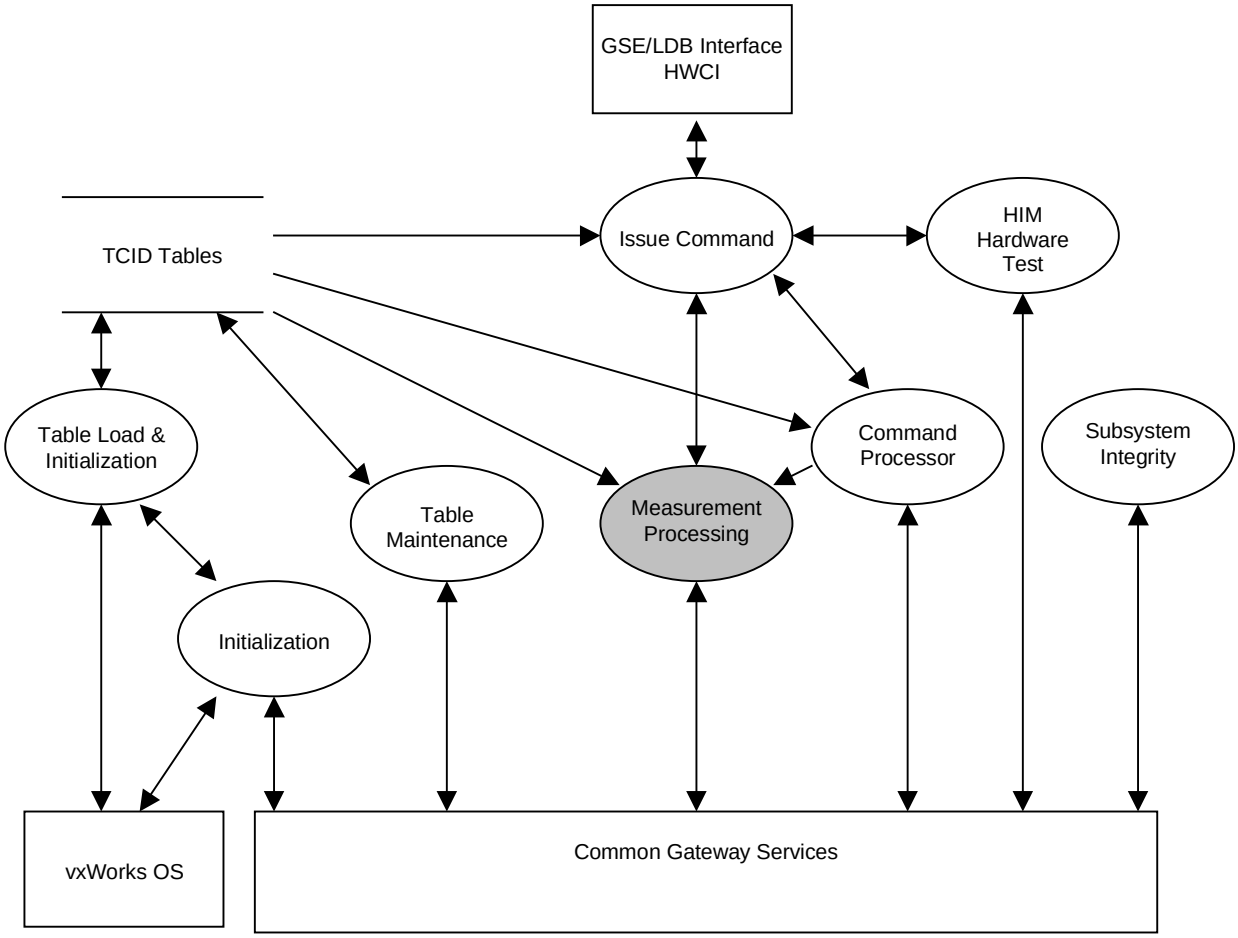
The GSE Issue Command CSC will monitor the active's uplink and downlink data busses. It will correlate the data between the two busses and forward the correlated data to the Measurement Processing CSC and to the Command Processor CSC.

6. GSE MEASUREMENT PROCESSING CSC

6.1 GSE MEASUREMENT PROCESSING CSC INTRODUCTION

6.1.1 GSE Measurement Processing CSC Overview

The GSE Measurement Processing CSC is responsible for performing the HIM measurement poll function. It uses HIM poll table and Command/Measurement Data Table (CMDT) information provided as part of the TCID to format and output HIM polls via the GSE Issue Command CSC. The HIM responses are changed checked against their current value in the CMDT and, when a change is detected, a change data write is performed via the Common Gateway Services CSCI.



6.1.2 GSE Measurement Processing CSC Operational Description

The GSE Measurement Processing CSC uses three poll rate tables (100 Hz, 10 Hz and 1Hz) that are provided as part of the TCID to control the acquisition of measurement data from the HIM's. The CSC will cycle through the poll tables, building output requests to be passed to the HIM via the GSE Issue Command CSC. Responses from the GSE Issue Command CSC will be passed to the FEPC Common GSE Measurement Processing CSC for possible output via Common Gateway Services.

6.2 GSE MEASUREMENT PROCESSING CSC SPECIFICATIONS

6.2.1 GSE Measurement Processing CSC Groundrules

None

6.2.2 GSE Measurement Processing CSC Functional Requirements

1. The GSE Measurement Processing CSC will be capable of cyclically issuing polls for measurement data to the HIM's.

2. The GSE Measurement Processing CSC will support polling of GSE HIM's with standard sample rates of 1, 10, and 100 samples per second.

3. The GSE Measurement Processing CSC will allow polling at multiples of the standard sample rates.

4. The GSE Measurement Processing CSC will communicate all change data with status, FDID and time to the Common Gateway Services CSCI.

5. The GSE Measurement Processing CSC will set invalid data indicators in the measurement status upon detection of an error during a HIM poll.

6. The GSE Measurement Processing CSC will provide the capability to convert analog counts to engineering units.

7. The GSE Measurement Processing CSC will be capable of performing up to a fifth-order polynomial expansion using standard IEEE 754 floating-point 32-bit coefficients to convert the measurement data to an engineering unit form.

8. The GSE Measurement Processing CSC will maintain the current value of each measurement.

9. The GSE Measurement Processing CSC in the active gateway will output HIM measurement data only if a change has occurred.

10. When a measurement is inhibited due to error or by manual command, the GSE Measurement Processing CSC will update the measurement's status.

11. The GSE Measurement Processing CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port.

12. The GSE Measurement Processing CSC will provide functions to convert all GSE data types from HIM format to RTCN format (e.g. count to floating point,)

13. The GSE Measurement Processing CSC will set the fail status bit for the measurement when either data acquisition and/or data processing is inhibited for the measurement.

14. The GSE Measurement Processing CSC will provide the capability to continue polling a specified HIM that has reported a Power Fail terminal error.

15. The GSE Measurement Processing CSC will consider data invalid upon detection of a measurement that is polled and no response is received.

NEW REQUIREMENTS FOR ATLAS

16. The GSE Measurement Processing CSC in the standby gateway will refresh the current value of all measurements and commands as part of switchover processing

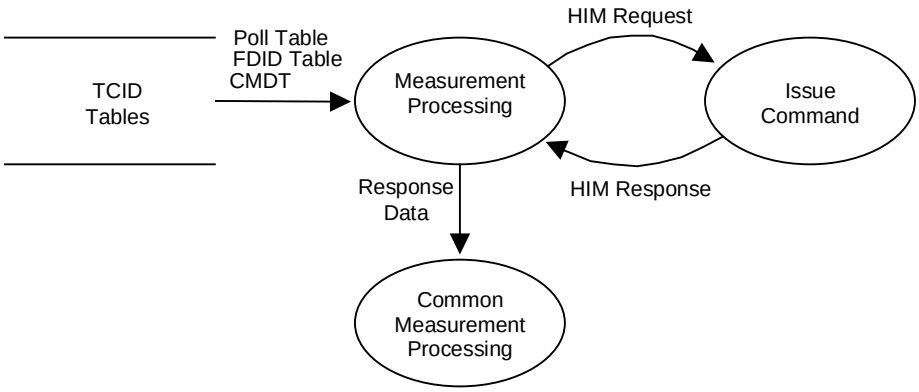
17. The GSE Measurement Processing CSC in the standby gateway will receive all GDB traffic from the active gateway via the Issue Command CSC and will use the GDB data to keep the current value in the CMDT up to date

6.2.3 GSE Measurement Processing CSC Performance Requirements

1. The GSE Measurement Processing CSC will be capable of processing 10,000 HIM polls per second.

6.2.4 GSE Measurement Processing CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



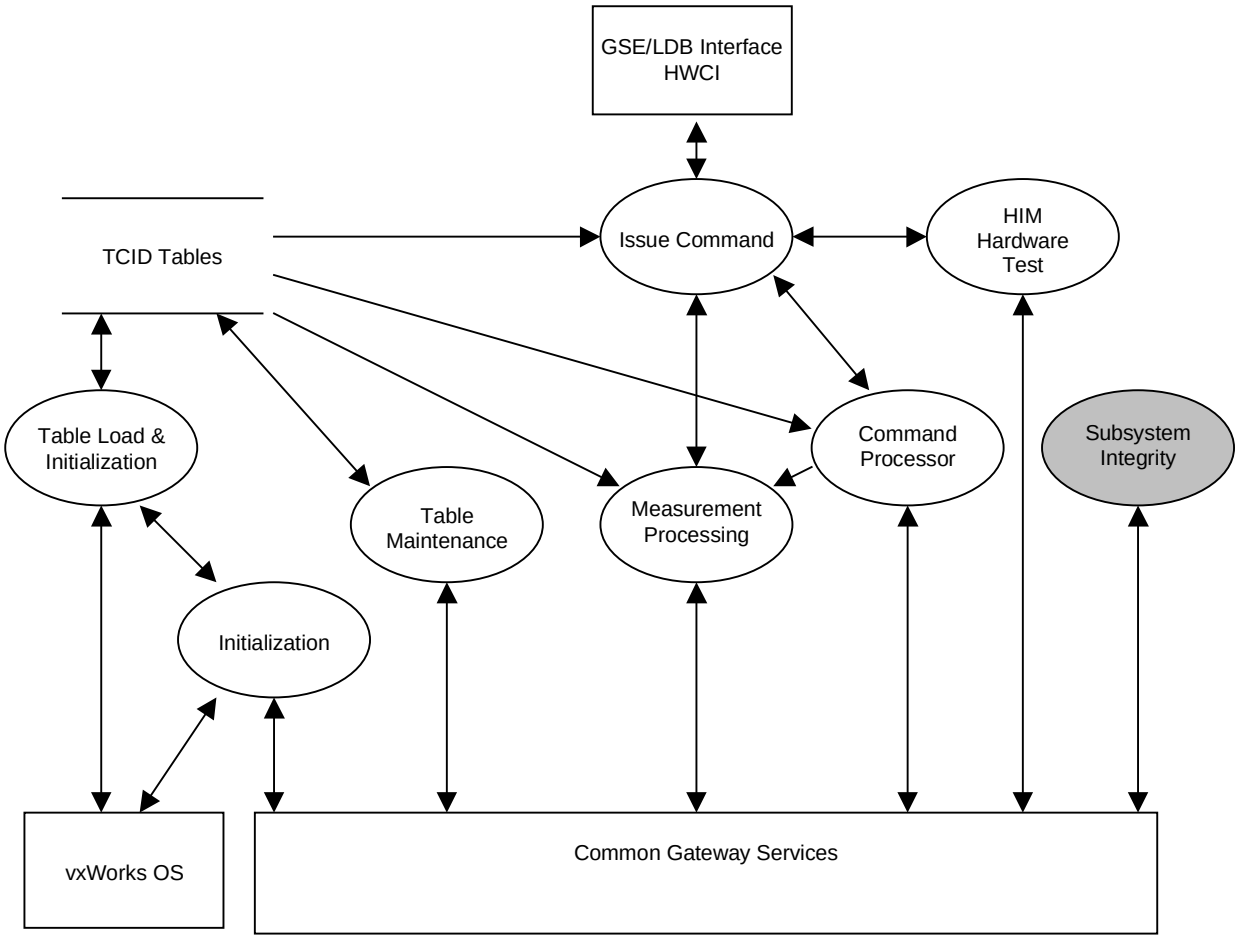
The GSE Measurement Processing CSC uses the poll tables, the FDID tables and the CMDT. It will scan the poll tables and output HIM poll requests using functions provided by the GSE Issue Command CSC. HIM responses from the GSE Issue Command CSC will be change checked and a change data write will be made if required to the Common Gateway Services CSCI.

7. GSE SUBSYSTEM INTEGRITY CSC

7.1 GSE SUBSYSTEM INTEGRITY CSC INTRODUCTION

7.1.1 GSE Subsystem Integrity CSC Overview

The GSE Subsystem Integrity CSC provides GSE unique redundancy and switchover functionality.



7.1.2 GSE Subsystem Integrity CSC Operational Description

The G SE Subsystem Integrity CSC is responsible for fielding the switchover system event code. The Subsystem Integrity CSC notifies all other GSE CSC's that a switchover has occurred. The Common Gateway Services CSCI is then informed that the switchover is complete so that it can upgrade the overall state of the gateway and make any system notifications required.

7.2 GSE SUBSYSTEM INTEGRITY CSC SPECIFICATIONS

7.2.1 GSE Subsystem Integrity CSC Groundrules

None

7.2.2 GSE Subsystem Integrity CSC Functional Requirements

NEW REQUIREMENTS FOR ATLAS

1. The GSE Subsystem Integrity CSC will notify all GSE CSC's when a switchover system event code is received.

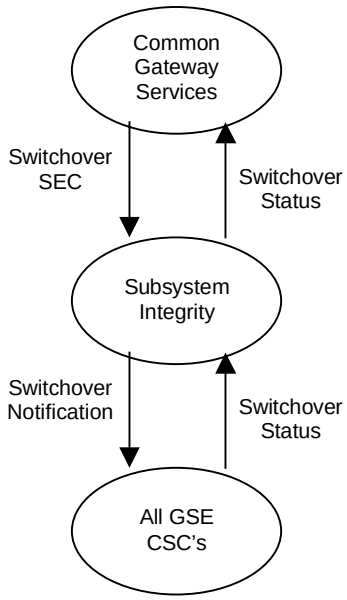
2. The GSE Subsystem Integrity CSC will notify the Common Gateway Services CSCI of the success or failure of this notification.

7.2.3 GSE Subsystem Integrity CSC Performance Requirements

No performance requirements have been identified for this CSC for Atlas.

7.2.4 GSE Subsystem Integrity CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



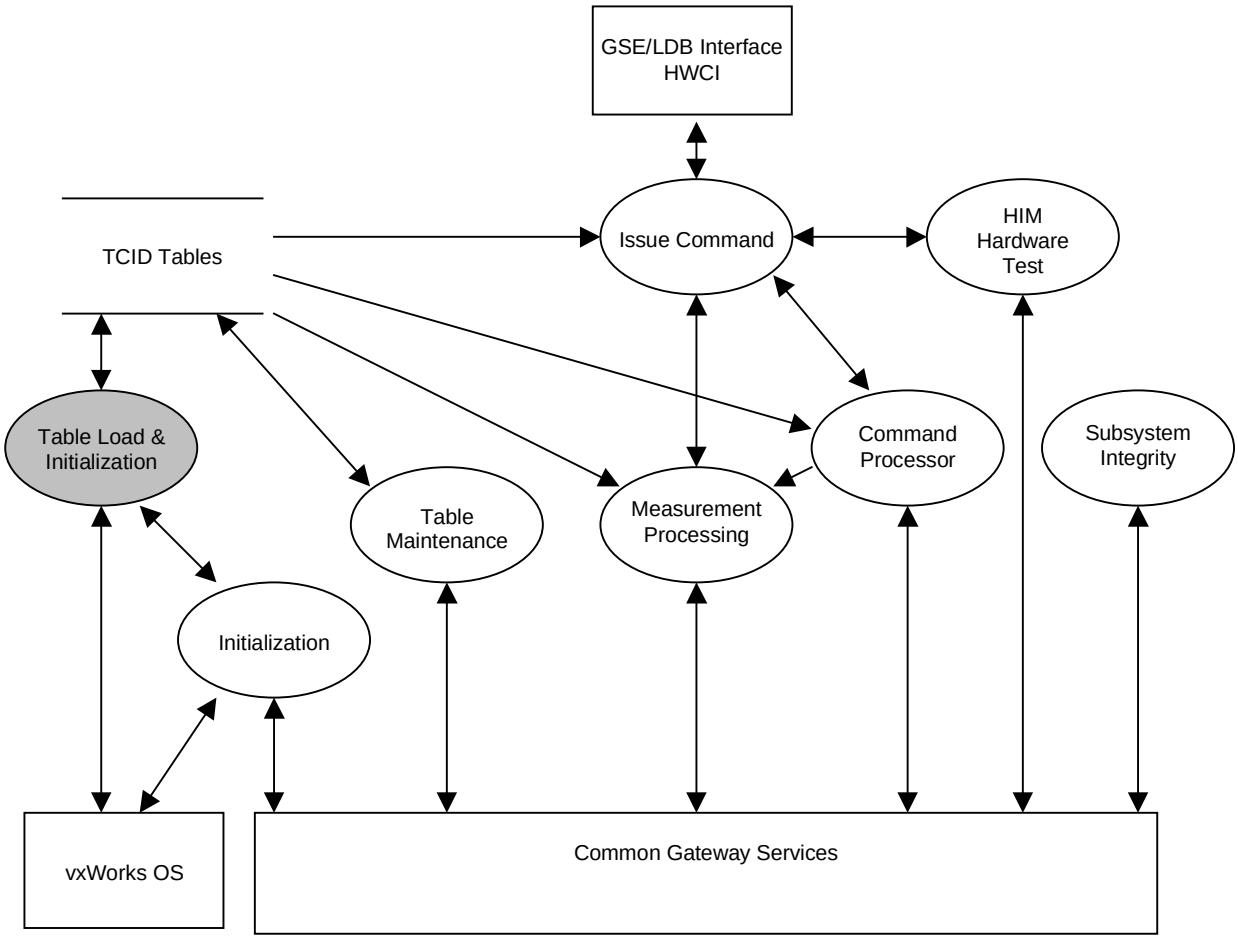
The GSE Subsystem Integrity CSC registers with the Common Gateway Services CSCI to receive the switchover system event code. The Subsystem Integrity CSC notifies all GSE CSC's that a switchover has been received by calling a predefined function for each CSC. The Common Gateway Services CSCI is then informed of the status of the switchover operation.

8. GSE TABLE LOAD AND INITIALIZATION CSC

8.1 GSE TABLE LOAD AND INITIALIZATION CSC INTRODUCTION

8.1.1 GSE Table Load and Initialization CSC Overview

The GSE Table Load and Initialization CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for loading the TCID tables from the hard drive into memory and verifying their content. It also provides the tables required for the Table Synchronization and Checkpoint functions that are part of Common Gateway Services.



8.1.2 GSE Table Load and Initialization CSC Operational Description

The GSE Table Load and Initialization CSC is commanded to load the GSE unique TCID tables from the local hard drive by the Common Gateway Services CSCI in response to a Load TCID command. The TCID files to be loaded are the Command Measurement Data Table (CMDT), the poll tables (100Hz, 10Hz and 1Hz), the FDID tables for discretes and the Engineering Unit Coefficient tables. These tables are formatted as ASCII flat files on the hard drive with one record per line. The first line of each file contains the number or records in the file. The GSE Table Load and Initialization CSC will open the file, obtain the number of records and allocate memory based on the record count. The CSC will use operating system functions to read each record and then verify that the expected number of entries are

present. Once all tables are read, verification checks will be performed.

8.2 GSE TABLE LOAD AND INITIALIZATION CSC SPECIFICATIONS

8.2.1 GSE Table Load and Initialization CSC Groundrules

- System software and TCID tables will be resident on the local hard drive.
- TCID tables will be loaded when an initialize TCID command is received.
- The following tables will be provided by build as part of the TCID information at load / initialization time:
  - GSE Command / Measurement Data Table
  - Polling Rate Tables (100Hz, 10Hz and 1Hz)
  - Discrete Command / Measurement FDID tables
  - Engineering Unit Conversion tables
  - GSE Health/Status FDID tables
  - HIM status FDID tables

8.2.2 GSE Table Load and Initialization CSC Functional Requirements

1. The GSE Table Load and Initialization CSC will load all required TCID tables from the local hard drive when the Initialize TCID command is received.

2. The GSE Table Load and Initialization CSC will respond to the Initialize TCID command with a success or fail status.

3. The GSE Table Load and Initialization CSC will be capable of generating system messages through the Common Gateway Services CSCI using the GCP Services API.

4. The GSE Table Load and Initialization CSC will be capable of requesting through the GCP Services API that a system message be written to a file on the local hard drive, the local console port, or the RTCN interface.

5. The GSE Table Load and Initialization CSC will perform the following verification checks on the loaded tables.
   - 5.1. Pointers from one table to another will be limit checked.
   - 5.2. EU coefficients which are used by the CMDT will be tested to ensure at least a first order polynomial is present.
   - 5.3. The 100 Hz poll table will be verified to contain 100 entries
   - 5.4. The 10 Hz and 1 Hz tables will be verified to contain a multiple of 10 entries
   - 5.5. Data types will be verified to be valid for GSE

6. The GSE Table Load and Initialization CSC, upon detection of a table load error, will attempt to continue loading tables in order to detect all errors possible prior to fixing and reloading the tables

NEW REQUIREMENTS FOR ATLAS

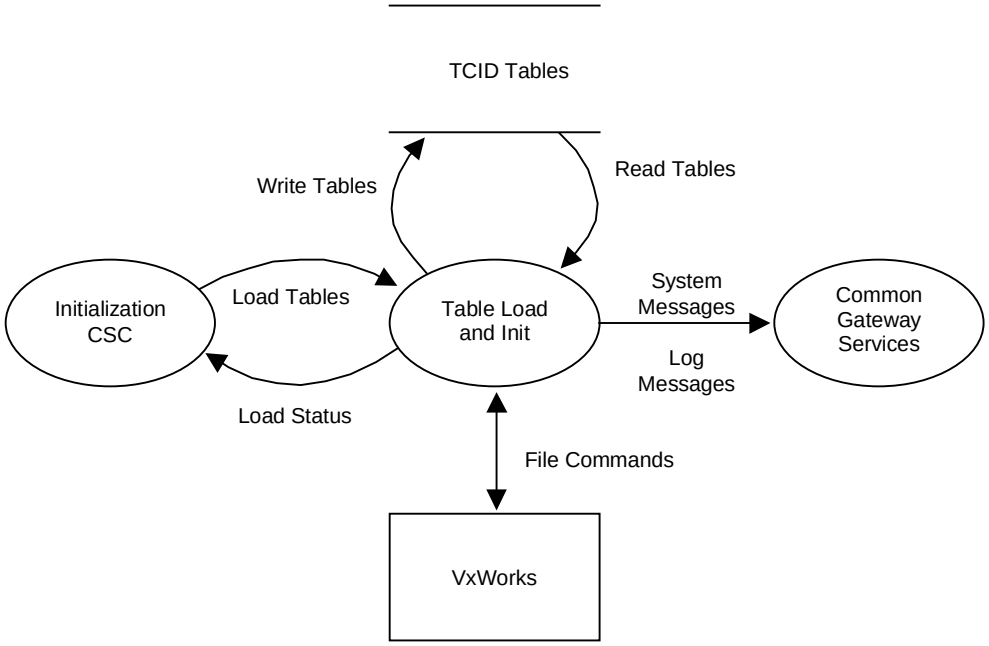
7. The GSE Table Load and Initialization CSC will provide the definition tables required by the checkpoint and table synchronization functions that are part of the Common Gateway Services CSCI.

8.2.3 GSE Table Load and Initialization CSC Performance Requirements

No performance requirements have been identified for this CSC for the Atlas delivery.

8.2.4 GSE Table Load and Initialization CSC Interfaces Data Flow Diagrams

External Data Flow Diagram



The GSE Table Load and Initialization CSC is commanded by the GSE Initialization CSC to perform the TCID table load in response to a Load TCID command. The GSE Table Load and Initialization CSC will use the fopen() function to open the files on the local hard drive. The number of records will be read and memory allocated based on the record size. The fscanf() function will be used to read each record into the table. When the end of the file is reached, the record count will be verified. Once all files are read, the GSE Table Load and Initialization CSC will perform verification checks.

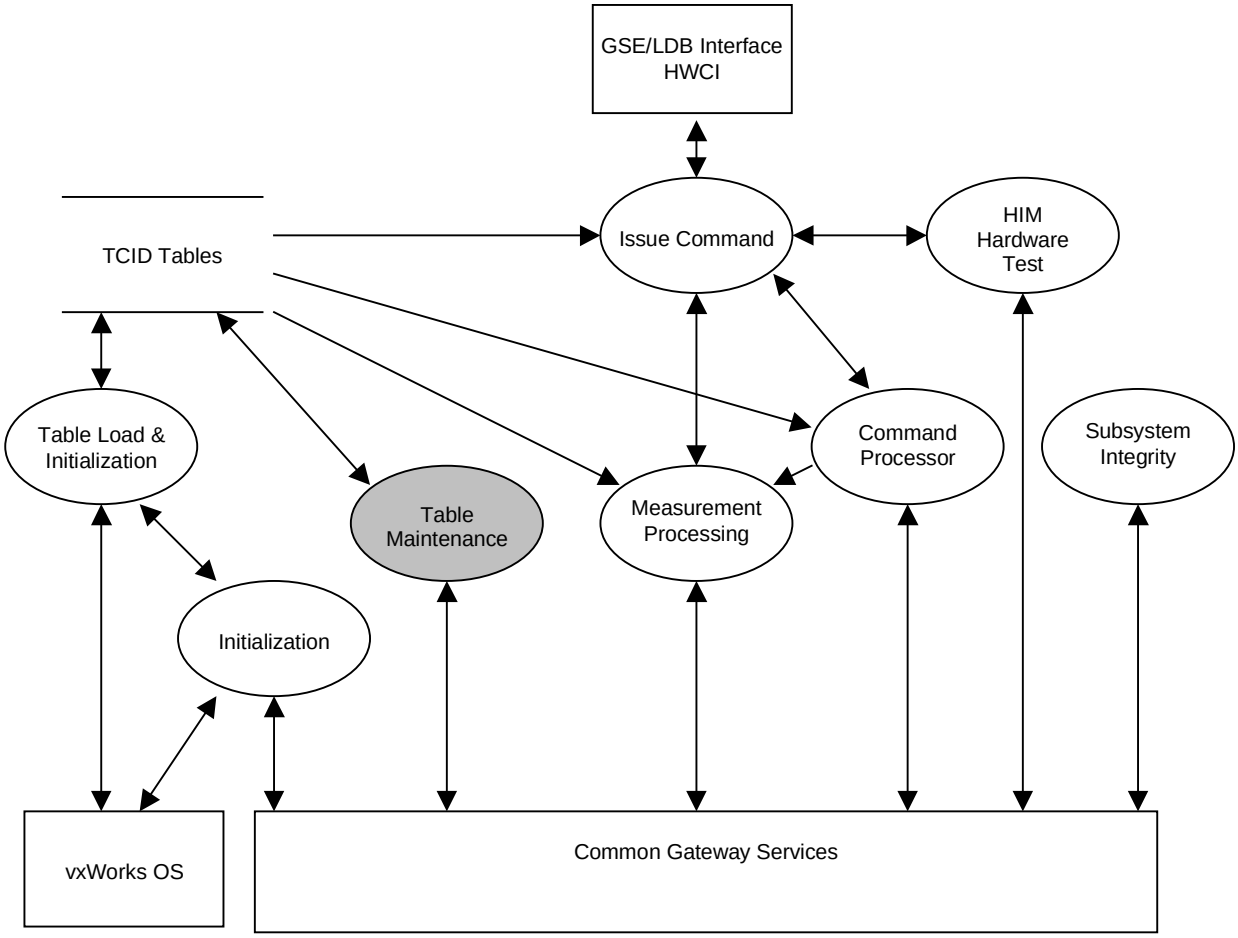
The GSE Table Load and Initialization CSC maintains definition tables which describe all tables and variables which are required to be checkpointed or synchronized between the active and standby gateways. These tables are made available to the Common Gateway Services CSC which is responsible foe executing the checkpoint/restart and table sync functions.

9. GSE TABLE MAINTENANCE CSC

9.1 GSE TABLE MAINTENANCE CSC INTRODUCTION

9.1.1 GSE Table Maintenance CSC Overview

The GSE Table Maintenance CSC is part of the GSE Gateway Services CSCI. The CSC is responsible for execution of all commands that modify the TCID tables.



9.1.2 GSE Table Maintenance CSC Operational Description

The GSE Table Maintenance CSC provides functions that are executed by the Common Gateway Services CSCI in response to commands received via the RTCN. These functions manipulate processing control indicators and other information in the TCID tables which control how data and commands are processed. The majority of these functions execute in line with the Command Processing Task. Functions that require more than minimal processing to complete will result in a message to a table maintenance task that will perform the function.

9.2 GSE TABLE MAINTENANCE CSC SPECIFICATIONS

9.2.1 GSE Table Maintenance CSC Groundrules

None

9.2.2 GSE Table Maintenance CSC Functional Requirements

1. The GSE Table Maintenance CSC will provide the capability to return the old entry and the new entry as part of the response to all table maintenance requests.

2. The GSE Table Maintenance CSC will process requests to activate/inhibit data processing globally. (Common Measurement Processing)

3. The activate data processing globally command in the active gateway will cause the current value of all measurements and commands to be output via change data. (Common Measurement Processing)

4. The GSE Table Maintenance CSC will process requests to activate/inhibit data processing on an individual FD. (Common Measurement Processing)

5. The activate FD data processing command in the active gateway will cause the current value of the FD to be output via change data. (Common Measurement Processing)

6. The GSE Table Maintenance CSC will process requests to activate/inhibit change processing globally. (Common Measurement Processing)

7. The GSE Table Maintenance CSC will process requests to activate/inhibit change processing on an FD. (Common Measurement Processing)

8. The GSE Table Maintenance CSC will process requests to read Engineering Unit Polynomial Coefficients. (Common Measurement Processing)

9. The GSE Table Maintenance CSC will process requests to modify Engineering Unit Polynomial Coefficients. (Common Measurement Processing)

10. The GSE Table Maintenance CSC will provide the capability to reset all inactive measurements in the MDT to active when requested by Activate Processing on all Measurements. (Common Measurement Processing)

11. The GSE Table Maintenance CSC will process requests to activate/inhibit command issuance on an FDID.

12. The GSE Table Maintenance CSC will process requests to status all command and measurement parameters. (Common Measurement Processing)

13. The GSE Table Maintenance CSC will process requests to change the hardware address of an individual measurement or command.

14. The GSE Table Maintenance CSC will process the change hardware address command only if data acquisition is inhibited, either globally or on the requested FDID.

15. If the new HIM address in a change hardware address command is not currently in the HIM presence table, the GSE Table Maintenance CSC in the active gateway will issue a HIM wake-up sequence to the new HIM. The

HIM will be activated or inhibited based on the status of the wake-up sequence.

16. The GSE Table Maintenance CSC will process requests to activate/inhibit polling on an individual HIM.

17. The GSE Table Maintenance CSC in the active gateway will issue a HIM wake-up sequence to the HIM specified in an activate HIM polling command.

18. If the switch scan option is selected in an activate HIM polling command, the GSE Table Maintenance CSC in the active gateway will: determine the status of all outputs for the specified HIM, update the current value in the CMDT and output a change data entry.

19. If the switch scan option is selected in an activate HIM polling command, the GSE Table Maintenance CSC in the active gateway will include in the response a list of those HIM outputs which did not compare with the current value in the CMDT.

20. The GSE Table Maintenance CSC in the active gateway will reject any activate HIM with switch scan option commands if a activate HIM with switch scan is currently in progress.

21. The GSE Table Maintenance CSC will process requests to change the sample rate on an individual measurement to either 1, 10 or 100 samples per second unless the measurement is supercommutated.

22. The GSE Table Maintenance CSC will process requests to return the sample rate on an individual measurement to its default value.

23. The GSE Table Maintenance CSC will prevent a sample rate change request if any of the following conditions occur:
    23.1. The sample rate specified is not a valid rate
    23.2. The sample rate specified is lower than the default rate

24. The GSE Table Maintenance CSC will reserve the default slot for the FD in the poll table upon receiving a change sample rate command.

25. Upon receipt of a restore rate to default command, the GSE Table Maintenance CSC will return the poll command to its original poll slot in the table.

26. The GSE Table Maintenance CSC will provide the following parameters to Subsystem Integrity:
    26.1. Number of free entries in 100 Hz poll table
    26.2. Number of free entries in 10 Hz poll table
    26.3. Number of free entries in 1 Hz poll table

27. The GSE Table Maintenance CSC will process requests to activate/inhibit polling on an individual measurement.

28. The GSE Table Maintenance CSC will be capable of generating system messages through the Common Gateway Services CSCI.

29. The GSE Table Maintenance CSC will be capable of requesting through the Common Gateway Services CSCI that a message be written to a file on the local hard drive or the local console port.

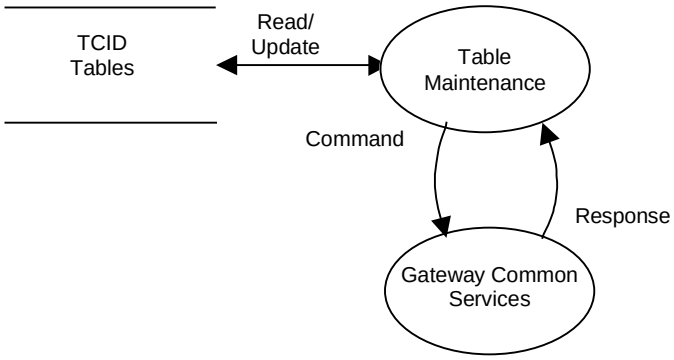
NO ADDITIONAL REQUIREMENTS FOR ATLAS

9.2.3 GSE Table Maintenance CSC Performance Requirements

No performance requirements have been identified for this CSC for the Atlas release.

9.2.4 GSE Table Maintenance CSC Data Flow Diagram

External Data Flow Diagram



The GSE Table Maintenance CSC provides functions that are executed by the Common Gateway Services CSCI in response to table maintenance commands received via the RTCN. These functions manipulate processing indicators and other information in the TCID tables which control how data and commands are processed.

Many of these commands will be handled by the Common Measurement Processing CSC that is part of the Common Gateway Services CSCI.